supplemented, was published early in 1906. This is the edition of which a translation has now appeared in Teubner's collection of text-books of mathematical science.

THE fifth volume of the second series of the Proceedings of the London Mathematical Society has now been published by Mr. Francis Hodgson. The volume includes an account of the meetings held during the session November, 1906, to June, 1907, and many of the papers read before the society during the session. Obituary notices are included of the late Colonel Mannheim and Dr. E. J. Routh. As the meetings of the society are recorded from time to time among our reports of societies and academies, it is unnecessary to do more now than mention the publication of the volume containing records of papers presented.

OUR ASTRONOMICAL COLUMN.

OCCULTATIONS OF URANUS IN 1908.—From Dr. Downing we have received, as an excerpt from No. 2, vol. lxviii., of the Monthly Notices, a table showing the times and angles of immersion and emersion for the occultations of Uranus by the moon observable at British observatories during the present year. The places specifically named are Adelaide, Melbourne, Sydney, Wellington, Natal, Perth (W.A.), and the Cape, and the dates of the occultations are April 22, May 19, July 13, August 9, and October 3. Dr. Downing hopes that the publication of these data will enable astronomers favourably situated to observe some peculiarities in the appearance of the planet at the time of occultation.

OBSERVATIONS OF COMETS 1907*d* AND 1907*e*.—The results of the observations of comets 1907*d* and 1907*e*, made at the Vienna Observatory with the 6-inch refractor, are recorded by Dr. J. Holetschek in No. 4231 (p. 99, February 3) of the *Astronomische Nachrichten*. Some of them for 1907*d* are particularly interesting, as, in addition to the brightness of the nucleus and of the comet as a whole, the observer gives the length of tail and the times before sunrise up to which the comet was observable. Thus on July 18, when the brightness of the whole comet was of the fourth magnitude, the brightness of the nucleus being 7·5 mag., the object was followed until 15h. 33m. (Vienna M.T.), that is, until 46m. before sunrise. On August 26, mag. 2·0, it was seen until 20m. before sunrise. The greatest length of tail measured was about 8°, on August 18.

Signor Abetti also records, in the same journal, a number of observations, made at the Arcetri Observatory, of these two objects during November and December, 1907.

PLANETS NOW VISIBLE.—With Mercury at its greatest eastern elongation on February 13, it may be possible, during the next night or two, to observe, with the naked eye, five of the major planets at the same time. On February 13 Mercury will set about 1½ hours after the sun, *i.e.* at about 6.30 p.m., some 10° south of west. Venus is still quite a bright object in the western sky, whilst Saturn sets, nearly due west, some three hours after sunset. Mars does not set until about 10.30 p.m., and is to be found in the constellation Pisces to the south-east of the Great Square of Pegasus.

At 6 p.m. Jupiter is now a striking object in the eastern sky, having risen some three hours earlier.

Mercury will, of course, be the most difficult object to locate, but, following the directions given in these columns on December 5, 1907 (p. 115, vol. lxxvii.), Mr. W. E. Rolston found the planet at 6.35 a.m. on December 6, and was able to follow it easily until 7.10 a.m. The observation was made at Wimbledon Park, the sky being clear and the sun rising at 7.51 a.m.

At present Uranus is in conjunction, and therefore invisible, but Neptune may be found, with a telescope, situated between the stars ϵ and ζ and near to η Geminorum.

ENCKE'S COMET, 1908*a*.—The following is a further extract from the ephemeris for Encke's comet given in No. 4222 (p. 363, December 18, 1907) of the *Astronomische Nachrichten* by M. Kamensky and Mdlle. Korolikov :—

Ephemeris 0h. (M.T. Berlin).

1908	α (app.) h. m.	δ (app.) ° ′	1908	α (app.) h. m.	δ (app.) ° ′
Feb. 12 ...	23 50·3 ...	+6 21·0	Mar. 3 ...	0 27 0 ...	+10 4·5
,, 20 ...	0 3·9 ...	+7 43·7	,, 7 ...	0 35·6 ...	+10 56·1
,, 28 ...	0 18 9 ...	+9 15·3	,, 11 ...	0 44·7 ...	+11 49·6

From this we see that the comet is apparently travelling in a north-easterly direction through the constellation Pisces, and should be sought, in the earlier part of the evening, some few degrees to the south of the Great Square of Pegasus. Its photographic magnitude on January 19 was 12·5, and its distance from both the sun and the earth is decreasing rapidly. According to Prof. Wolf's observations, the above ephemeris required corrections of +2·4m. and −24′ on December 25.

Some interesting notes on the successive reappearances of Encke's comet appear in No. 2 (February 1, p. 13) of the *Gazette astronomique*.

A CATALOGUE OF ZODIACAL STARS.—A catalogue of zodiacal stars, principally prepared for use in occultations of stars by the moon, appears as part iii., vol. viii., of the Astronomical Papers prepared for the use of the American Ephemeris and Nautical Almanac. This catalogue was prepared by Mr. H. B. Hedrick, and all the catalogues employed in the investigation were reduced to the same absolute system as Prof. Newcomb's Catalogue of Fundamental Stars, which appeared as part ii. of the same volume. The catalogue includes 1607 stars, and gives the definitive positions for the epochs 1900·0 and 1920·0. Centennial and secular variations and proper motions are also given.

METEORS OBSERVED ON JANUARY 2.—Observing at Hjörring, North Jutland, Herren P. Muusmann and H. Wanning saw a number of meteors in the region between Cygnus and Pegasus on January 2. The observations were made between 8.10 and 8.20 p.m., and during the last five minutes more than thirty meteors were counted. The position of the radiant is given as 300° + 61° (*Astronomische Nachrichten*, No. 4230, p. 95, February 1).

THE WINDS OF NORTHERN INDIA.[1]

THE phenomena of atmospheric motion may be considered and discussed from three main points of view. They may be (1) regarded in their relation to the general system of winds prevailing over a rotating earth unequally heated, and having an annual period of temperature variation; (2) considered in their dynamic relation to the synchronous distribution of the various other meteorological elements, more particularly the pressure and temperature, in their vicinity; (3) arranged in order to facilitate comparison with one another at different times and seasons, and to exhibit the connection between wind and climatic conditions in such a way as to enable account to be taken of this connection in a general survey of meteorological conditions and in relation to forecasts. In the memoir before us, the main feature is the development and discussion, from the third standpoint, of the results of anemographic records at Allahabad and Lucknow during the years 1890–1904 and 1878–1892 respectively. Sir John Eliot prefixes the discussion by a short account of the synchronous distribution of pressure and temperature at Lahore and Allahabad, which is very suggestive of the method to be adopted and the results to be used in a discussion from the second standpoint. The modifying influences of the orographic distribution are too considerable to admit of close connection between the results recorded and the general atmospheric circulation, and no attempt has been made to develop such connection.

[1] "Memoirs of the Indian Meteorological Department, being Occasional Discussions and Compilations of Meteorological Data relating to India and the Neighbouring Countries." Published under the direction of Dr. G. T. Walker, F.R.S. Vol. xviii., part iii. V. A Discussion of the Anemographic Observations recorded at Allahabad from September, 1890, to August, 1904. VI. A Discussion of the Anemographic Observations recorded at Lucknow from June, 1878, to October, 1892. By Sir John Eliot, K.C.I.E., F.R.S. (London: Harrison and Sons, 1907.) Price 2 rupees.

Allahabad is situated about 300 feet above sea-level at the junction of the Ganges and Jumna, where their general direction is changing from E.S.E. to E. The plain of these rivers forms part of a great plain 1300 miles long and about 200 miles broad, in no part of which does the height above sea-level exceed 1000 feet. On the north it is bounded by the Himalayas, which change their direction from N.W. to W. in passing from the Punjab to Assam. Near Allahabad the direction is approximately W.N.W.

To the south the ground rises gradually to the plateau of Central India, across which runs a low range of hills from Bombay in an E.N.E. direction, passing about 150 miles south of Allahabad.

Allahabad is therefore near to the south edge of the flat bottom of a trough with sides converging towards the east, the south side being very slightly inclined and of small elevation compared with the north. Lucknow is 110 miles N.W. of Allahabad, and lies at the centre of the flat bottom. The motion of the air in such a trough is complicated, but the general result is that air flowing in or out transversely is deflected towards the right in its course, the effect being in both cases to produce motion parallel to the trough. On these motions will be superposed the effect of the general circulation of the atmosphere, which is both actually and theoretically westerly in the upper regions so long as the trough is definitely north of the thermal equator, becoming easterly when the thermal equatorial region includes the trough.

The exposure of the anemometer at Allahabad was excellent, but at Lucknow was not so good, and at the latter place the instrument, during the later years, was not kept in proper working order. It is probably partly due to these causes that the records from Lucknow show winds considerably weaker than those from Allahabad.

The results of the records have been arranged in tables giving for each month for each hourly interval of the day (1) the mean movement of the air, irrespective of direction; (2) the number of winds recorded under each octant of the compass; (3) the number of miles recorded under each octant of the compass; (4) the mean coordinates of the resultant wind movement.

For exhibiting the leading features of the air movement these results have been charted, and a series of carefully drawn plates is given at the end of the discussion. In addition to wind roses, showing the amount of wind in each direction and the proportion of calms, there is an excellent set of diagrams showing for each month of the year the diurnal variation of the air movement and the mean monthly resultant velocity. The diurnal variation bears no direct relation to the ordinary diurnal pressure variation.

For the purposes of discussion, Sir John Eliot divides the year into two periods, the dry season extending from the middle of October to the middle of June, and the wet season during the remaining four months. The dry season is further subdivided into the dry cool season, November to February, and the dry hot season, March, April, May.

During the cool season, pressure gradients are small, and the main feature of the distribution is the persistent continental high pressure. Locally, the isobar through Allahabad at 8 a.m. in January runs nearly through Lucknow in a N.W. direction, becoming more northerly as the day advances, while the wind changes its direction from W.N.W. to N.N.W. Thus there appears to be a correspondence between the wind direction and the local pressure gradients similar to that noted every day on the synchronous weather charts for temperate latitudes. The variations are, however, too rapid for the development of the full effect of the earth's rotation in producing an approach to parallelism between the isobars and the wind direction.

It is important in considering this rotation effect to remember that it acts as a modifying influence in conjunction with the pressure distribution, and although the latter is in the end the outcome of the air motion and temperature variation, there is nothing to warrant the assumption that the combined effect on air motion is to produce always a veering in the wind. Air starting from rest and moving across a permanent system of isobars will veer as it progresses, but a change in the direction of the gradient may more than counteract this action of the earth's rotation.

Briefly, if the pressure fall in unit distance along two perpendicular straight lines, Ox, Oy, by amounts α, β, and if the resultant velocity due to the effects of the pressure gradient, friction, and the earth's rotation be proportional to the gradient and make a constant angle θ with the isobars, the components of velocity in the two directions Ox, Oy, will be $k(\alpha \cos\theta - \beta \sin\theta)$, $-k(\alpha \sin\theta + \beta \cos\theta)$.

If, now, $\bar{\alpha}$, $\bar{\beta}$ are the mean values of α, β deduced from mean pressure distribution, and if u, v are the mean values of the components of wind velocity, we find

$$\bar{u} = k(\bar{\alpha} \cos\theta - \bar{\beta} \sin\theta), \quad \bar{v} = -k(\bar{\alpha} \sin\theta + \bar{\beta} \cos\theta)$$

and the same relation, therefore, holds for mean values as for synchronous distributions. The angle θ depends on friction and on the time the motion has been in progress; $\bar{u}$ and $\bar{v}$ will therefore vary between limits depending on these factors. The general relation is, however, simple, and it appears desirable to test its applicability to motion in the large unbroken plain, ample and suitable data for which are furnished by the present series of memoirs.

An examination of the diagrams shows that at both Allahabad and Lucknow the cold season has the greatest percentage of calms and the smallest air movements. The latter are, however, steadier than at any other season. Calms are $2\frac{1}{2}$ times more frequent at Lucknow than at Allahabad, the average number at the former place being 30 per cent. of the total number of observations. The mean direction of the air movement is slightly W. of N.W. at both places. The diurnal variations of magnitude are similar at both places, the maximum being reached about 3 p.m., when the average velocity is more than double that of the evening. The changes in direction at the two places are very different. The wind usually veers throughout the day at Allahabad, and backs during the night; at Lucknow the main feature is considerable, backing from 11 a.m. to 3 p.m., and slow veering for the remainder of the day, with slight and very irregular movements at night, the changes being much less than those at Allahabad.

In the dry season the winds are of maximum intensity at Lucknow and of mean intensity at Allahabad. At both places the actual resultant air movement is a maximum for the year. The winds are relatively very steady in March and April, and very unsteady in May. The mean direction changes from N.W. to N. at Allahabad, and from W.N.W. to N.W. at Lucknow during the course of the season. The diurnal changes are similar to those of the cold season, but are more marked, and in May the changes in direction are greater at Lucknow than at Allahabad, but still take place in the reverse direction.

The winds during the wet season are remarkable for their increased variability in direction. The actual amplitude of the diurnal variation of magnitude is considerably less than for the dry season, the winds being less feeble during the night and of average intensity in the day. At Allahabad the mean direction of air movement in July is from W.S.W., but during the early morning hours it is nearly S., and at 4 p.m. it is N.W. by N. At Lucknow the mean direction is N.E., and the variations are less marked, but there is a very remarkable change from E. by N. to N.E. by N. between 10 a.m. and 11 a.m. The motion is the same as if the places were in a trough of ascending motion the axis of which moved towards Allahabad in the course of the day.

Diagrams are also drawn to show the variations of air movement along, and perpendicular to, the axis of the trough, appropriately called the axial and transverse variations. The axial variation shows similar features throughout the dry season. There is a fairly rapid increase in the daytime until 4 p.m., after which there is a rapid decrease. During the night there is practically no change. In the wet season the increase is much smaller at both places. At Allahabad the maximum is reached at 11 a.m., and the decrease takes place slowly during the remainder of the day. There is a feeble secondary maximum at 2 a.m. At Lucknow the increase takes place slowly and irregularly from midnight to midday, while there is a similar decrease until 10 p.m. The transverse variation is throughout markedly different at the two

stations. At Allahabad the northerly component *diminishes* during the dry season until midday, after which it increases until about 5 p.m., the epochs advancing two hours from November to April. At Lucknow the northerly component *increases* rapidly to a maximum at 11 a.m., and diminishes again to a minimum at 3 p.m., after which the changes are slow and irregular.

In the wet season there is an average increase in the northerly component at Allahabad from midnight until 4 p.m., and a corresponding decrease for the rest of the day. At Lucknow the main feature is a sudden increase in the northerly component between 10 a.m. and 11 a.m., after which there is a decrease with oscillations to the minimum at 10 a.m. on the following day, the rapid afternoon fall being absent.

These features of the transverse oscillation, together with the greater steadiness of the winds at Lucknow, appear to be partly due to its more central situation; but the backing of the wind during the day indicates that a longer period is necessary to produce the larger motion in the direction of the trough than is requisite for the smaller transverse variation. It is probable that for Allahabad the earlier transverse motion is modified by the effect of the Central Plateau; this effect diminishes in the afternoon, and is replaced by the influence of the Himalayas, which is, of course, weaker than at Lucknow. The nature of the transverse variation appears also to imply that the effect of the Himalaya range in constraining the air motion in the plain is actually produced dynamically through the medium of rotary motion transverse to itself rather than through a forcing of the stream lines to conform to parallelism with a rigid boundary.

The solution of the problems presented, and their connection with convective motion not shown directly by the winds, would be considerably advanced by a knowledge of the vertical temperature gradient in the free atmosphere over the plain.

A noteworthy feature is brought out in the auxiliary tables, representing the steadiness of the wind by the ratio of the resultant air movement to the total movement. The winds of the wet season are most steady near midnight, while in the dry season the epoch of maximum steadiness is about 4 p.m.

The accompanying tables exhibit the main features of the annual variation and the distribution of the wind.

Season	Month	Lucknow: Percentage amount of wind to total amount in each month from N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Monthly percentage of wind	Allahabad: Percentage amount of wind to total amount in each month from N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Monthly percentage of wind
Dry	October	26·0	9·2	6·5	1·9	1·2	6·2	18·1	30·9	5·3	13·9	14·7	13·0	6·5	3·5	7·8	21·6	19·0	5·7
	Nov. ..	30·3	8·2	1·9	1·7	0·9	5·5	21·3	30·2	3·9	15·2	11·0	10·6	6·4	2·7	5·1	25·7	23·4	4·3
	Dec. ...	22 5	7·7	3·3	2·1	1·8	13·2	27·6	21·8	4·8	10·4	8 9	7·5	4·2	3·4	7·4	34·0	24·2	5 6
	January	19·0	7·3	6 9	3·6	2·8	10·6	25·5	24·3	6·3	8·8	11·8	15 0	3·9	2·2	8·2	32·2	17·9	6 9
	February	22·4	7·3	4·1	2 6	1·9	8·4	25·7	27·6	8·4	7·2	10·4	11·8	6·4	2·8	8·0	33·0	20·4	7·2
	March...	16·3	5·9	3·3	4·1	3·5	11·6	30·8	24·5	11·6	10·4	13·6	6·7	3·3	2·3	6·4	34·6	22·8	9·4
	April ...	16·8	9·1	4·2	2·0	3·9	10·8	26·0	27·2	12·1	12·7	14·4	6·9	4·6	5·3	7·9	28·0	20·2	9·1
	May ...	12·6	10·2	15·7	6·0	4·1	9·0	22·2	20·2	11·1	15·0	16·2	16·5	8·2	5·0	4·6	16·4	18·2	10·8
Wet	June ...	13·9	14·0	20·3	7·2	5·5	9·4	14·6	15·1	11·2	9·1	18·2	21·5	9·1	7·1	9·3	14·6	11·1	11 8
	July ...	16·5	14·4	22·0	9·7	7·3	11·2	9·7	9·2	9·9	7·6	12·8	16·5	7·5	11·7	14·2	18·5	11·2	10·8
	August	18·3	13·0	19·5	7·8	7·5	11·1	10·6	12 2	7·5	8·4	16·3	18·3	7·8	5·8	12·0	20·7	10·7	10·1
	Sept. ...	17·4	15·8	16 6	6·3	3·0	7·3	15·6	18·0	7·9	10·9	17·5	17·5	8·9	4·6	11·4	18·7	10·5	8·3
	Year ...	18·0	10·4	11·2	4·9	4·0	9·8	20·7	21·0	100	10·6	14·3	14·2	6·6	5·2	8·8	23·8	16·5	100

We note that the winds were taken from the records of Beckley's anemograph, but there appears to be no statement regarding the factor used in the reduction to miles per hour. In any case, the winds are comparatively feeble, the maximum recorded in any single hour being thirty-five miles at Lucknow and forty-five miles at Allahabad. There appears to be an inconsistency between the statement on p. 320 of the years of maximum and minimum movement and the table on the preceding page, so that either the suggestion of periodicity or the table needs readjustment.

The arrangement of the memoir is excellent, and it is full of suggestiveness to the student of meteorology. It forms a valuable contribution to our knowledge of Indian meteorology. E. G.

MEDICAL INSPECTION IN LONDON.[1]

DR. JAMES KERR, medical officer (education) to the London County Council, here adds another to the series of his admirable reports. These always contain much that cannot be neglected by the students of educational conditions, and this report is no exception. It consists of sixty-six pages crowded with new materials of the highest scientific and practical value. Administratively, probably the most important statement in the report is that "a point has now been reached, as to whether the greater part of the medical inspection shall remain fruitless, or whether the Council shall take steps which will justify its later interference to see that its younger dependents have a fair chance of benefiting properly by the education offered. Treatment as a public concern will have to be considered in respect to certain educational matters, such as visual troubles, discharging ears, ringworm, and the care of the teeth, in which neither the private practitioner nor the hospitals can give hope of either providing sufficient or satisfactory relief for most of the cases requiring it" (p. 3). A composite committee has been appointed to inquire into this serious problem, on which the circular recently issued by the Board of Education has a definite bearing. The report of this committee will be looked for with interest alike by the hospitals and the practitioners.

The general results of the medical inspection confirm the work of previous years. The medical officers are now coming to closer quarters with the children, and this report contains many careful pieces of special research. These it is here possible only to indicate. Emphasis is laid on the urgency of the inspection of infants, especially of infants of three to five years of age. Tubercular bone and joint disease can then be most readily prevented. In inspection of the secondary schools and training colleges there was noticed a "general ignorance of how to expand the thorax by deep inspiration" (p. 8). Among girls, "headaches were complained of by 20·5 per cent. . . . Exaggerated movements, corrugated foreheads, insomnia, and somnambulism were met with. Several cases of overstrain were specially reported" (p. 9). "The average standard of physique is low." There is a careful mathe-

[1] London County Council. Report of the Education Committee of the London County Council submitting the Report of the Medical Officer (Education) for the year ended March 31, 1907.